MEMO

To: **Daniel Weinberg and Chuck Nelson; U.S. Bureau of the Census**

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Re: ***Peer Review of Segregation Measures in Iceland and Weinberg (2002) and corresponding Census website***

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Introduction and Overview

John Iceland and Daniel Weinberg (2002) have provided a careful, professional, well-explained and illustrated analysis of segregation of minority groups in the U.S. and a comprehensive database that is important for the monitoring and fuller understanding of this phenomenon. It is absolutely essential that the Bureau of the Census continue providing (hopefully in a somewhat augmented form, as explained below) this battery of segregation indices, given its deserved reputation for fair, timely, and accurate statistical reporting. These segregation indices provide a widely accepted, objective set of indicators measuring in a multi-dimensional way an important population phenomenon of interest to the public, scholars, and policymakers.

When dealing with a complicated, emotionally-fraught, multi-dimensional subject like residential racial-ethnic segregation, it is too often the case that presentations distort or over-simplify to make some pre-ordained political points. Fortunately, this is not the case with the Iceland-Weinberg report or the reams of published data upon which it was based. Their work presents and describes accurately and objectively what the numbers say and how they should be interpreted.

Unfortunately, some of the best-known indices of segregation have some difficulties in being interpreted with common language. Take the dissimilarity index (D), for example. When the value of this index is 100 it can be consensually said that such a situation represents "segregation," because all neighborhoods would have 100 percent of only one racial-ethnic group or another residing therein. When the D index value is zero, however, the language becomes more contentious. A D index of zero for two racial groups A and B would necessarily occur when all neighborhoods under investigation had exactly the same proportions of groups A and B; but would such necessarily represent "integration?" A D index of zero would occur if every neighborhood had either: (1) one percent group A and 99 percent group B, (2) 50 percent of each; or (3) one percent group B and 99 percent group A (or many other mixes). Our colloquial use of the term "integration" certainly seems stretched in considering situations (1) and (3).

This is an illustration of the importance of considering multiple indicators of residential patterns when discussing this topic, and certainly before one draws any conclusions about whether a certain indicator signals "integration" or not. Here, to know whether a D index of zero involved situations (1), (2), or (3) it would be useful to compute an exposure (interaction) index, which would provide the average percent of group A living in a member of group B's neighborhood, and vice versa. Thus, there are potentially serious limitations of any study that makes claims about segregation or integration based only on a single indicator, a weakness that the Iceland-Weinberg report avoids.

The other realm where the conventional segregation indices reported in Iceland-Weinberg are limited is in their ability to measure what is going on *within* neighborhoods. All the indices published by the Census Bureau are calculated based on the distributions of racial-ethnic groups *across* neighborhoods. It would also be informative to compute measures of diversity or mixture *within* each neighborhood in a metropolitan area, then combine them into a composite index that would tell us about the incidence of "diverse" neighborhoods there. I amplify on this suggestion later.

My more detailed comments follow as responses to the four questions constituting the scope of work for this review.

1. Are the Five Dimensions Specified in Massey and Denton (1988) Adequately Measured in Iceland and Weinberg (2002)?

Yes. Iceland and Weinberg (2002) calculate indices that provided multiple measures of each of the five dimensions of segregation identified by Massey in Denton, so there is no problem of adequacy of coverage. This redundancy of measures is important for the future because, as Massey, White and Phua (1996) find, the way indices collapse into factors depends on the sample of metro areas, the racial-ethnic group involved and the year of measurement (1990 vs. 1980). Moreover, the "best" single measure for a given dimension may not always correspond to those originally recommended by Massey and Denton (1988). For example, Massey, White and Phua (1996) recommend using ACL instead of SP for clustering, and DEL instead of RCO as a measure of concentration, based on analyses of 1990 black-white segregation indices and factor loadings for all metro areas. (I note with some curiosity that Iceland and Weinberg (2002) take their advice on the latter, but not the former.) Thus, allowing that forthcoming analyses similar to those above but using 2000 and 2010 data may also find some changes in the segregation factor structure over time as well as differences across groups, the long list of measures by Census should provide the needed coverage for future scholars.

2. Do the 19 Measures of Segregation in Iceland and Weinberg (2002) Meet Minimal Technical Requirements?

Overall, both the report and the website meet minimal technical requirements. I have three areas where I would have recommended improvements, however.

First, I would wish for more clarity in the written report that three of the four measures used for each minority group (D, DEL, SP) necessarily involve comparisons between the given minority group AND non-Hispanic whites ("whites," hereafter). That is, they measure spatial patterns of a minority group relative to patterns for whites. This omission makes the report more ambiguous and potentially subject to misinterpretation, because it is feasible to compute these indices between different pairs of groups.

Second, key segregation indices for whites (e.g., white isolation index, exposures of whites to other groups) are omitted both from the report and the website. Therefore it might appear to the casual reader that whites are not segregated (only minorities are, since they are only ones with data presented…), or that who mixes with whites is of no importance to whites (or the rest of society, for that matter). As we move toward a society where whites will soon lose their majority status this omission is unfortunate (more below).

Third, the information regarding exposure indices (both those reported by the Census website and those that are omitted) can lead to problems for researchers. In the report and the Census website all exposure (P*) indices are computed as if there were only two pairs of groups present: whites and the given minority group, i.e., we are given the exposure of minority group X to other members of X and to whites as if whites were the only other group in the neighborhood. Numerically this means that the computed exposures of minority group X to whites and the isolation of minority group X sum to 1.0. I understand that this procedure replicates that employed in Massey and Denton (1988), but it produces a figure for exposure to whites that is not literally accurate unless all neighborhoods inhabited by X members were inhabited only by whites as well. I would prefer that the exposure indices for all groups (including whites) be calculated such that the sum of exposures to ALL other groups (including one's own) summed to unity. I find this the most significant technical shortcoming of the data on the website, because it overstates the "real" exposure of a minority group to whites and provides no information about the exposures to other minority groups.

3. Are There Additional Measures that Should Have Been Included in Iceland and Weinberg (2002)?

Yes. First is the aforementioned detail on exposures of whites to all groups and of all other groups to each other, not just whites.

Second, I would urge the Census Bureau to calculate measures of INTEGRATION (or diversity), not simply segregation. I believe that there is a consensus that the measurement of diverse neighborhoods is conceptually distinct from the measurement of segregation, mainly because in the former one is attempting to

measure differentiation of population *within* the areal unit (census tract), instead of across them. There also seems widespread agreement that diversity within a tract should be measured with a multi-group measure. There are several reasonable candidates I would forward in this regard: Diversity Index (Maly, 2000), Entropy Index (Modarres, 2004), or Simpson's D (Herfindahl-Hirshman) Index. I.e., let:

π_{im} = proportion of individuals in group m (m = 1, 2, … , M) in tract i
π_{m} = proportion of individuals in group m (m = 1, 2, … , M) in the whole metropolitan area

- Simpson's *D* (or Herfindahl-Hirschman) index

$$D_i^* = 1 - \sum_{m=1}^{M} \pi_{im}^2$$

  - Range: [0, 1]; 0 completely homogeneous; 1 completely heterogeneous

- Entropy (Information, Shannon-Weaver, or Shannon-Wiener) index

$$H_i = \sum_{m=1}^{M} \pi_{im} \ln \frac{1}{\pi_{im}} = -\sum_{m=1}^{M} \pi_{im} \ln \pi_{im}$$

  - Range: [0, ln$M$]; 0 when one of the groups has probability 1 (completely homogeneous); ln$M$ when π_{im} = 1/M (completely heterogeneous)

- Maly (neighborhood diversity) index

$$M_i^* = 1 - 1/2 \sum_{m=1}^{M} \; | \pi_{im} - \pi_m |$$

  - Range: [0, 1]; 0 = completely homogeneous when entire neighborhood comprised of a group with a miniscule metropolitan presence; 1 = heterogeneous with all groups in neighborhood matching their metro-wide share

I would recommend that the Census calculate *all three* of these measures for basic racial-ethnic groups as in Iceland and Weinberg (2002) and then provide a frequency distribution and measures of central tendency and dispersion of these indices for each metro. In this way individual researchers could, if they wished, set up ranges of values that they considered "diverse" and then compute incidence measures.

It also would be instructive to compute a group-weighted average of a particular neighborhood diversity index for each major racial-ethnic group. Analogous in construction and interpretation to an exposure index, these weighted diversity measures could be interpreted as the "degree of neighborhood racial-ethnic diversity experienced by the typical member of group X."

Furthermore, many people's notion of "integration" has a component of "stability" associated with it. There have been several ways in which scholars have tried to conceive of and operationalize this stability (Galster, 1998). One easy-to-understand way, however, is simply to see which diverse neighborhoods at the beginning of a decade remained so by the end of a decade, and which diverse neighborhoods at the end of a decade became so during it. "Diversity" might be defined for this exercise as neighborhoods scoring within a predetermined (arbitrary) range of values for any of the multi-group diversity indices above. The Census might then report in 2010 the percentage of such diverse census tracts in 2000 that remained so by 2010, and the percentage of such diverse tracts in 2010 that became so since 2000.

4. Are There Any Improvements Needed for Similar Calculations from the 2010 Census?

Following up on my comments from 2. and 3. above, I would strongly recommend that the Census Bureau calculate and publish on their website the full set of:

- All the pair-wise permutations of the various inter-group (relative) segregation measures
- The battery of multi-group segregation indices
- Distributional characteristics of three tract diversity indices, and measures of stability of diverse tracts

The first battery of permutations would provide more complete information about how various minority groups were segregated from each other, not just from non-Hispanic whites.

The second battery should include the six multi-group indices proposed by Reardon and Firebaugh (2002) and the multi-group spatial proximity index proposed by Grannis (2002). They provide detailed formulas and supportive evaluations of these indices. These seven multi-group segregation indices would provide an important complement to the multi-group neighborhood-level diversity indices advocated above.

The third battery should involve descriptive statistics based on the three diversity indices noted above.

References cited:

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